Sport-City Planning. A Proposal for an Index to Support Decision-Making Practice: Principles and Strategies

Ginevra Balletto[1(✉)], Giuseppe Borruso[2], Alessandra Milesi[1], Mara Ladu[1], Paolo Castiglia[3], Marco Dettori[3], and Antonella Arghittu[3]

[1] DICAAR - Department of Civil and Environmental Engineering and Architecture, University of Cagliari, 09100 Cagliari, Italy
{balletto,mara.ladu}@unica.it

[2] DEAMS - Department of Economics, Business, Mathematics and Statistics Sciences "Bruno de Finetti", University of Trieste, 34127 Trieste, Italy
giuseppe.borruso@deams.units.it

[3] DMCS - Department of Medical, Surgical and Experimental Sciences, University of Sassari, Sassari, Italy
{paolo.castiglia,madettori}@uniss.it

Abstract. Currently more than half of the world population - between formal and informal urban settlements - has been affected by the health crisis. In cities there are great difficulties in facing the new challenges that are intertwined between urban-environmental and economic aspects. Cities were among the first and most affected areas hit by the epidemic, however they have always been places of maximum creativity and innovation, deriving precisely from the aggregation processes of social and economic networks. These same networks actually favored the spread of the health crisis. In recent months, many scenarios have been advanced for a renewed urban development, to favor the reduction of contacts, including the idea of 'villages' and the "city of 15 min". In this framework, some questions arise: what are the multi-sectoral policies that can make cities more inclusive, sustainable, reducing vulnerability and health risks? What individual commitment can cities make into a model of health promotion? These questions guided the authors in evaluating the role of the Sport-city in the research of the post-pandemic city through qualitative/quantitative indicators in the main Italian provinces and metropolitan cities, between health and well-being and environment, proposing a specific index (UPA - Urban Physical Activity Index) to support Sport-city planning initiatives aimed at the health-well-being of communities through urban design.

The paper is part of the activities of the Interdepartmental Center "Cagliari Accessibility Lab" of the University of Cagliari. This study was supported by the research grant for the project "Investigating the relationships between knowledge-building and design and decision-making in spatial planning with geodesign" funded by Fondazione di Sardegna (2018).
This paper is the result of the joint work of the authors. In particular: Sect. 1 has been written by G. Balletto. Sect. 2 has been written by P. Castiglia, M. Dettori, A. Arghittu; Sect. 3.1 by A. Milesi, M. Ladu; Sect. 3.2 by G. Balletto, Sect. 3.3 by A. Milesi, M. Ladu; Sect. 4 by G. Balletto; Sect. 5 by A. Milesi, M. Ladu; Sect. 6 by Ginevra Balletto and Sect. 7 by G. Borruso.

© Springer Nature Switzerland AG 2021
O. Gervasi et al. (Eds.): ICCSA 2021, LNCS 12952, pp. 255–269, 2021.
https://doi.org/10.1007/978-3-030-86973-1_18

Keywords: Health city · Sport city · Metropolitan cities · Urban planning · Post pandemic city

1 Introduction

The research hereby presented is part of a wider, multidisciplinary project the authors have been carried on since the recent Covid-19 outbreak, aware that the topics related to planning at urban and regional level need an integrated and multifaceted approach and a particular care and attention towards health issues. The paper, in particular, was aimed at stressing the importance of physical activity in improving the quality of life and health. In such a sense, the attention has been on analyzing the performances of Sardinian provinces and the metropolitan city in terms of the parameters that are more likely to positively affect human health from the planning point of view.

To do that, a novel approach was adopted, as that of considering in a combined index the performances that characterize the different areas considered – provinces and the metropolitan city of Cagliari in the Sardinia region and island – considering the structured and unstructured activities that can be addressed to sport and other "healthy" activities. The attention in particular was on urban planning and therefore on how such indicators can be used both as a means to evaluate the effect of a set of actions put in place by local governments, and as a suggestion for future policies for improving the quality of urban life.

This contribution is divided into the following parts:

- Background of health aspects (Sect. 2), which focuses on health aspects referred to the city;
- Materials (Sect. 3), which focuses on the urban and geographic aspects (Sect. 3.1), on the recent advances in the scientific debate relating to the identification of indicators to measure the health-well-being of communities (Sect. 3.2), with particular reference to regional and intermediate level indicators to support Sport-city planning in Sardinia (Sect. 3.3);
- Methods (Sect. 4) in which a method is proposed for the determination of an Urban Physical Activity index (UPA Index);
- Case study (Sect. 5).
- Results and Discussion (Sect. 6) which analyzes the results obtained;
- Conclusions (Sect. 7).

2 Background of Health Aspects

Regular physical activity (PA) is one of the major lever factors in general health prevention. It has been demonstrated that it reduces morbidity and mortality by decreasing heart disease, diabetes, high blood pressure, colon cancer, feelings of depression/anxiety and weight, building and maintaining healthy bones, muscles, and joints [1–9]. It has been demonstrated that 30 min of moderate PA, such as daily walking, is recommended to obtain significant health benefits [10, 11]. Despite the well-known benefits for health,

large proportions of the population in many developed countries are physically inactive. Today the insufficient PA is a growing global concern, with estimates ranging from 33% of adults worldwide who are physically inactive [12]. Globally, approximately 9% of premature mortality is attributable to insufficient PA [13, 14]. In Europe, a sedentary lifestyle is assumed to be responsible for about 600,000 deaths per year, with a percentage between 5 and 10% of total mortality by country, and the loss of 5.3 million years of life in good health. In addition, PA tends to decrease with increasing urbanization [15]. This is the reason why today an effective collaboration between public health professionals, sociologists, psychologists, economists, urban planners, architects, and public safety officers is needed to design feasible interventions, both physical and intangible, that support an enhancement of PA level [1]. In Italy, the situation is similar and many observational epidemiological studies offer an indicative framework of the reality. According to the Cardiovascular Epidemiological Observatory, on average, 34% of men and 46% of women aged 35–74 do not perform any PA during leisure time. Among them, the elderly population (men and women aged 65–74) amounts to 31% of men and 51% of women [16]. The national survey of the Health Surveillance System, labelled "OKkio alla salute 2019", on eating habits and PA of primary school children of 6–10 years, shows that 20.3% of children play sport for no more than one hour per week and did not exercise the day before the interview. Only 1 out of 4 children went to school on foot or by bicycle [17]. Another national survey, named "Health Behaviour in School-aged Children - Italy", regards children aged 11, 13, and 15 years old, and it shows that the fifteen-agers do less PA (47.5% of males and 26.6% of females) than the thirteen-agers (50.9% males and 33.7% females) and that females perform less physical activity than their peers in all three age groups examined during the investigation [18]. Data obtained from the national surveillance system "PASSI" ("Progressi delle Aziende Sanitarie per la Salute in Italia"), which monitors the health of the adult Italian population of 18–69 years, showed that during the period 2013–2016 about 32.5% of interviewees were completely sedentary [19]. The habit of PA is not the same in all Italian regions and the analysis of local data shows a North-South gradient. In particular, in the Sardinia Region, it is estimated that 26% of the population can be considered completely sedentary. There is also a distorted perception of the PA: 12% of sedentary people believed to practice enough. The percentage of sedentary remains very high even in subgroups of the population that could benefit most thereof (particularly people with symptoms of depression, hypertensive, obese or overweight). It should be reported that the operators in the health sector do not yet sufficiently promote active lifestyles among their patients, although this data varies among Local Health Agencies. The positive effects of PA are evident both socially and economically. Strategies to increase active living are receiving widespread attention and support across several sectors. Indeed, this important goal can only be achieved with the application of cross-sectorial strategies, with interventions on the environmental, social, and economic factors that together influence the adoption of active lifestyles [19].

The idea that a walkable environment may function as an important vector for health promotion in urban areas is widely accepted and sustained among scholars and professionals of social health and planning domains. A social-ecological perspective on health

suggests that social and environmental factors play an important role in increasing physical activity [20]. There is growing scientific evidence that urban design features at the neighborhood level such as green spaces, parks, pedestrian areas, etc., are associated with an increased PA and with beneficial health impacts on the population [21–24]. As a consequence, environmental and policy approaches to promote physical activity, such as walking trail construction and promotion, sustainable mobility policies, environment, and urban design favoring walking and cycling and physical activity in general, are being widely recommended, yet sparse data exist on their effectiveness [25–27].

3 Materials

3.1 Materials: Urban Geographic Aspects

The link between the physical characteristics of urban contexts and public health impacts open new scenarios between Urban Health [23] and Sport-city (Spatial integration of sports facilities and mixing sport (structured and/or unstructured) [28]. Furthermore, since 54% of the world population lives in urban areas, with a forecast of 70% by 2050, it follows the strategic and decisive role of jointly planning built environments and open spaces, such as: pedestrian areas, cycle paths, parks and environmental ecosystem services [29–31]. The risk factors related to urbanization include the following macro-categories: urban heat islands [32, 33] and air pollution [34], apparently disjoint, but at present related to each other [35, 36]. In this sense, scientific knowledge and design practice identify health-sport urban planning and design strategies, through: green infrastructures, cycle and pedestrian areas [30]; and more generally a social and functional mix derived from urban and environmental regeneration [37–40] according to the principle - Design for All [41]. Furthermore, although the sport industry is criticized, because it is often incompatible with the principles of sustainability [42, 43], on the contrary, interventions aimed at community sport - open to all by age and status, help to enhance the strategic role of public space outdoor [44] on individual and collective health [45]. In this sense, in Italy, PA increases from generation to generation [46, 47], stabilizing around the age of 50. This increase is influenced by the level of education (52% of those who practice PA are graduates). In Italy, more than four out of ten people practice PA in a completely unstructured way, that is, in full autonomy, preferring open spaces and not always equipped [48]. The health crisis, like all previous epidemics, has recalled the need to combine: community, health and urban design. In this sense we intend to evaluate in qualitative and quantitative terms the role of the Sport-city for a renewed urban development in the light of the recent health emergency, proposing a specific index (UPA Urban Physical Activity) to support the post-pandemic city.

3.2 Fair and Sustainable Well-Being (Bes) Index

In the last twenty years, the scientific debate on measuring the health-well-being of communities has developed a lot [49]. The international crises (energy-environmental, financial-real estate, economic-social and recently also health) have made it urgent to develop new parameters capable of supporting political decision-makers in defining

new scenarios. In particular, with the "Fair and Sustainable Well-being (Bes)" index, the National Council for Economy and Labor (CNEL) and the National Statistical Institute (ISTAT) responded to the need to identify indicators on the state of health and well-being in Italy [50]. The report on Fair and Sustainable Wellbeing (published annually, Italy) is at the forefront of the international scene in terms of development of indicators (regional and sometimes provincial level) and aims to integrate GDP (gross domestic product), not more sufficient to represent the complexity of contemporary society. The set of indicators proposed for about a decade express the multidimensionality of health-well-being and the numerous aspects that contribute to the quality of life of the community. Over the years, new indicators have been introduced, collected in 12 domains. Since 2016, some Bes indicators have become part of the national economic planning process (Law 163/2016), used in the Economics and Finance Document, to assess the impact of the proposed policies. According to the latest Bes 2020 report [51] - due to the health emergency - the following synthetic picture emerged in Italy (Table 1):

Table 1. The Italian condition according to the Bes Report 2020. Authors: A. Milesi and M. Ladu

Object	Year	↑ ↓	Value (%)
Sedentary people	2020		34%
Sedentary lifestyle_Gap women – men	2010–2020	↓	7,8%–6,3% (women are more sedentary than men)
Sedentary lifestyle_Age	2020		20% (from adolescents to people aged 24) 70% (people aged 75 and over)
Sedentary lifestyle_ Central IT	2019–2020	↓	35,1%–30,2%
People who practiced physical activity for 1 average day	2020 (1st lockdown)		22,7% (people aged 18 and over)
Overweight people	2020	↑	45,5%
Overweight people_men	2020		54,7%
Overweight people_women	2020		36,9%
Overweight people_ Northern IT	2019–2020	↑	42,1%–43,4%
Overweight people_ Southern IT	2019–2020	↑	49,3%–50,4%
Overweight people_ Central IT	2019–2020	↓	43,7%–42,2%

In particular, with the health emergency in Italy in 2020 there was:

- an expectation life of 82.3 years (down by 0.9 years compared to 2019 data); this was especially evident in Northern Italy and is more evident in Lombardy, where there was a decrease of 2.4 years compared to 2019;
- a difficulty in accessing health care: in fact, 1 in 10 citizens did not use it even if they needed it. Furthermore, the health emergency pushes to accelerate the implementation

of the 2030 Agenda in a logic of transformative resilience: not by going back to the pre-crisis situation, but to boost a decisive change in urban development models based on sustainability, locally and globally, of territories and communities jointly [52]. In fact, the health crisis has highlighted the need for a change of perspective through territorial and urban design approaches that put the health and well-being of the community at the center.

3.3 Regional and Intermediate Indicators to Support Sport-City Planning. The Sardinia Case

The Sardinia Region has geographical and climatic characteristics that allows practicing a significant variety of outdoor sports - hiking, swimming, running, sailing. In particular, in the city of Cagliari, the regional capital, as well as a metropolitan city, the PA (structured and unstructured) has been enhanced in the last 10 years [30]. With the recognition of "European City of Sport" for 2017 (European City of Sport) by ACES Europe, Federation of Capitals and European Cities of Sport, in the city of Cagliari it has been established that all the PA constitutes a fundamental part for the health-well-being of the community, promoting socialization and social inclusion, as well as the dissemination of civic and ethical values [53].

Table 2. Bes indicators for main factors correlated to the PA, referring to the Sardinia Region (SAR) and the national context (IT). Authors: A. Milesi and M. Ladu

		2018		2019		2020	
		SAR	IT	SAR	IT	SAR	IT
Health	Bes_1.11	38.2	44.8	39.7	44.9	42.5	45.5
	Bes_1.14	33.8	35.7	34.6	35.5	31	33.8
Education and training	Bes_2.2	51.5	61.7	54.2	62.2	53.7	62.6
	Bes_2.3	21.5	27.8	21.6	27.6	–	–
Job and reconciliation of lifetime	Bes_3.1	56.1	63	57.3	63.5	55.4	62
Economic well-being	Bes_4.9	19.3	11.3	15.6	10	–	–
Social relations	Bes_5.9	17	21	20.1	23.9	23.4	23.7
Subjective well-being	Bes_8.2	63.6	66.2	63.7	68	69.6	69.4
Environment	Bes_10.8	78.6	70.1	73.2	69	76.2	70.1

where: Bes_1.11: Excess weight (Standardized rates per 100 people); Bes_1.14: Sedentary lifestyle (Standardized rates per 100 people); Bes_2.2: People with at least a high school diploma (25–64 anni); Bes_2.3: Graduates and similar (30–34 years); Bes_3.1: Employment rate (20–64 years); Bes_4.9: Low labor intensity (%); Bes_5.9: Generalized trust (%); Bes_8.2: Leisure satisfaction (%); Bes_10.8: Satisfaction with the environmental situation (%).

The important recognition comes from the enhancement and promotion of the PA in programs and projects for the transformation and regeneration of entire urban areas,

both on a local scale and of supra-local and territorial interest [28]. Among the most important public initiatives of strategic importance, some already completed, others in the construction phase or planned, are the recovery project of the Lungomare Poetto (about 10 km) and the project for the new stadium (30,000 seats) [54]. Following the assessments developed previously, some Bes indicators were selected for the case of the Region of Sardinia on the basis of the main factors related to the PA: health, education and training, work and reconciliation of life times, economic well-being, social relations, well-being and subjective environment (Table 2) [55]. From Table 2 it emerges that Sardinia always presents values very close to the Italian average. On the other hand, they are higher in relation to the low intensity of work (Bes_4.9) and satisfaction with the environmental situation (Bes_10.8). Also the indicator on subjective well-being (Bes_8.2) slightly exceeds the Italian average for the year 2020. Furthermore, the data on excess weight (Bes_1.11), shows a constantly increasing trend both in Sardinia and in Italy, although sedentary lifestyle decreases slightly (Bes_1.14). This analysis, however, is based on data referring to the years prior to the spread of the Covid-19 pandemic and, therefore, to the restrictions that in fact limited the free movement of people, modifying lifestyles, also in reference to PA. To complete the representation of the PA in the urban environment, the two parts that make it up were then evaluated: structured and de-structured activity. By structured activity we mean activities related to sports federations, managed by specific subjects (public or private), while by de-structured activity we mean all those activities carried out outdoors individually and/or collectively, in a self-managed manner. In particular, the structured activity was represented by the sportsmanship index proposed by 'Il Sole 24 ore' [56] which, for the year 2020, considered the effect on sport deriving from the health emergency. Below the summary of the data relating to the position (Ranking) and the sportsmanship index (Score) attributed to each province of the Sardinia Region in the three-year period 2018, 2019 and 2020 is shown (Table 3). The data reveal how the metropolitan city of Cagliari always holds high positions in the national ranking, strongly detaching itself from the positions held by the other provinces of the Region, starting with the one closest to it, the province of Southern Sardinia, confirming the central role that the metropolitan area continues to perform with respect to its immediate territorial context. Since 2018, the year following the achievement of the title of European City of Sport, Cagliari has stood in third place in Italy, falling to ninth place in 2019 and fifteenth in 2020, according to a downward trend due, for this last year, the restrictions due to the spread of the COVID-19 pandemic, which resulted in the closure of sports facilities, the interruption and postponement of a series of amateur and competitive sporting events.If it is true that the province of Southern Sardinia recorded a sharp decline in 2020, the provinces of Oristano and Nuoro, in central Sardinia, record positions among the last in the national rankings in all three years analyzed in this study. It could therefore be argued that the COVID-19 effect has generated more evident negative impacts in the metropolitan city of Cagliari and in the province of Southern Sardinia. The de-structured sporting activity required a specific elaboration, proposed by the authors, based on the quantitative evaluation of pedestrian areas, cycle paths and parks [57, 58] closely linked to urban design.

Table 3. Sport index score (S) and ranking (R) assigned to the provinces of the Sardinia Region in 2018, 2019 and 2020. Authors: A. Milesi and M. Ladu

	2018		2019		2020	
Provinces	S	R	S	R	S	R
Cagliari	828.79	3	773.61	9	790.24	15
Sud Sardegna	228.97	71	202.7	79	180.41	104
Oristano	205.68	97	217.7	97	270.07	91
Nuoro	167.63	103	158	105	163.22	105
Sassari	395.46	60	426.01	58	477.48	56

Figure 1 compares the data relating to structured and de-structured sporting activity in the provinces of Sardinia and the metropolitan city of Cagliari for the three-year period 2018, 2019 and 2020.

			2018	2019	2020
CAGLIARI					
SPORT	structured	sportsmanship index	828.79	773.61	790.24
	unstructured	Pedestrian areas (sqm/inh)	0.5	0.5	0.2
		bicycle-line (sqm/100 inh)	4.5	4.4	3.4
		Urban green (sqm/inh)	54.8	54.9	54.8
SUD Sardegna					
SPORT	structured	sportsmanship index	228.97	202.7	180.41
	unstructured	Pedestrian areas (sqm/inh)	0.5	0.5	0.2
		bicycle-line (sqm/100 inh)	4.5	4.4	3.4
		Urban green (sqm/inh)	54.8	54.9	54.8
ORISTANO					
SPORT	structured	sportsmanship index	205.68	217.7	270.07
	unstructured	Pedestrian areas (sqm/inh)	-	0.1	0.1
		bicycle-line (sqm/100 inh)	-	-	-
		Urban green (sqm/inh)	47.5	47.5	47.4
NUORO					
SPORT	structured	sportsmanship index	167.63	158	163.22
	unstructured	Pedestrian areas (sqm/inh)	0.1	0.1	0.1
		bicycle-line (sqm/100 inh)	0.3	0.3	0.3
		Urban green (sqm/inh)	32.7	31.8	32.7
SASSARI					
SPORT	structured	sportsmanship index	395.46	426.01	477.48
	unstructured	Pedestrian areas (sqm/inh)	0.1	-	-
		bicycle-line (sqm/100 inh)	0.4	0.4	0.4
		Urban green (sqm/inh)	14.3	16.9	14.3

Fig. 1. Values recognized for structured and unstructured sport in the Sardinia Region for the three-year period 2018, 2019, 2020 (Please note that Cagliari and South Sardinia hold the same values for unstructured activities, as data are referred to their aggregation). Authors: A. Milesi and M. Ladu.

The metropolitan city of Cagliari and the province of Southern Sardinia are considered together as the sources are often not updated to the current administrative spatial

structure, although from 2016. This performance is due not only to the presence of sports services and equipment but also to a series of urban facilities - pedestrian areas, cycling and urban green.In particular, the province of Oristano records low values for pedestrian areas, no value for cycling, against a good endowment of urban green. On the contrary, the province of Sassari records values similar to the Cagliari context as regards cycling, compared to a less significant amount of urban green. The same province records an average value, in regional reference, as regards the services in support of the structured PA.

4 Methods

The proposed method consists in determining an Urban Physical Activity index (UPA Index), in order to quantitatively represent the unstructured PA, connected to the urban design of pedestrian areas, cycling and urban green areas. Based on the previous paragraphs, the UPA index can be represented as follow:

$$UPAIndex = \frac{\sum_{i=1}^{n} i * W_i}{\sum_{i=1}^{n} W_i}$$

where:
i_1 = pedestrian areas/100 inhabitants
i_2 = cycling/100 inhabitants
i_3 = urban green/100 inhabitants
W_1 pedestrian areas = $1/n_1$ * EUL
W_2 cycling = $1/n_2$ * EUL
W_3 urban green = $1/n_3$ * EUL
and EUL (Efficient Use of Land) = efficient use of land which represents the synthetic index (score 0–10) of the trend of land consumption/residents and the level of urbanization/residents and 1/n 1–3 represents the incidence factor respectively for pedestrian areas, cycling and urban green areas on EUL. In summary, the proposed UPA index referring to PA de-structured by using the incidence of EUL, allows you to connect land use efficiency and urban design, obtaining a representative index also in terms of urban ecologies [37, 59, 60].

5 The Case Study

The UPA index was applied to the Sardinia case for each province for the three-year period 2018, 2019, 2020.

In particular, $1/n_1 = 0.075$; $1/n_2 = 0.025$; $1/n_3 = 0.15$ were determined empirically from the evaluation of the urban and territorial context of the province and the Public Works Plans.

Table 4 shows the input data (i_1, i_2, i_3; W_1, W_2, W_3) and output of the proposed method for the evaluation of UPA index.

Table 4. Input and output data (UPA Index) by province of the Sardinia Region for the three-year period 2018, 2019, 2020. Authors: A. Milesi and M. Ladu.

	i_1	i_2	i_3	EUL	W_1	W_2	W_3	UPA index
2018								
Cagliari + Sud Sardegna	0.5	4.5	54.8	9.2	0.69	0.23	1.38	**33.48**
Oristano			47.5	4	0.30	0.1	0.6	**28.50**
Nuoro	0.1	0.3	32.7	5.2	0.39	0.13	0.78	**19.68**
Sassari	0.1	0.4	14.3	4	0.30	0.1	0.6	**8.65**
2019								
Cagliari + Sud Sardegna	0.5	4.4	54.9	8.6	0.65	0.215	1.29	**33.53**
Oristano	0.1		47.5	5.4	0.41	0.135	0.81	**28.53**
Nuoro	0.1	0.3	31.8	3.9	0.29	0.0975	0.585	**19.14**
Sassari		0.4	16.9	3.2	0.24	0.08	0.48	**10.18**
2020								
Cagliari + Sud Sardegna	0.2	3.4	54.8	7.8	0.59	0.195	1.17	**33.28**
Oristano	0.1		47.4	3.8	0.29	0.095	0.57	**28.47**
Nuoro	0.1	0.3	32.7	3.6	0.27	0.09	0.54	**19.68**
Sassari		0.4	14.3	3	0.23	0.075	0.45	**8.62**

Figure 2 shows the related UPAs in Sardinia by intermediate territorial area.

The results of the proposed method were presented and discussed in Sect. 4 and Section.

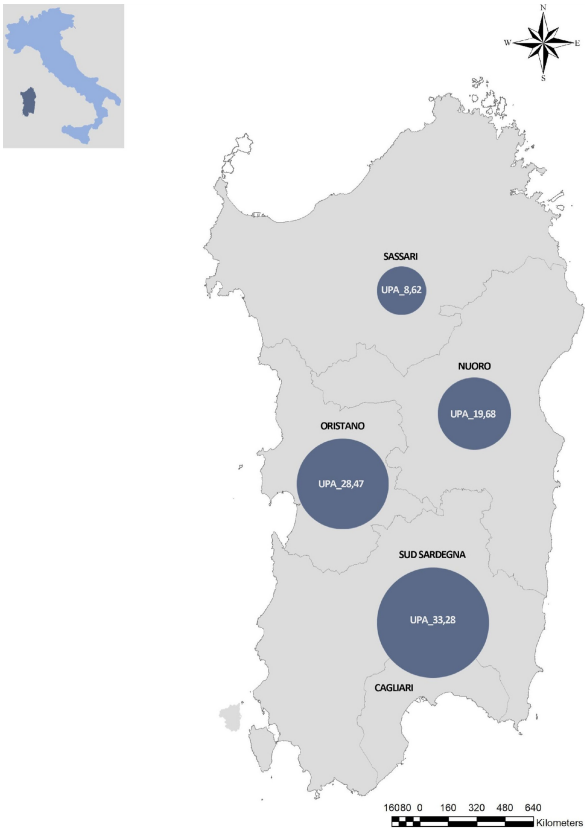

Fig. 2. The UPA Index in Sardinia. Authors: A. Milesi and M. Ladu.

6 Results and Discussion

The research hereby developed and proposed was aimed at proposing a novel approach in addressing issues related to health in its consideration with PA (Physical Activities, including sport ones) and the relation they can have with city planning. The approach led to the development to a suited-for-purpose index capable of combining de facto existing sport activities and practices, particularly at urban level, both related to structured and unstructured solutions. In a real world scenario, such combination seems to be the most natural one, as physical activities and active life are both related to structured practices, as in terms of sport associations, clubs, gyms, playing courts and grounds, etc., so as in terms of the spontaneous and unstructured ones, let us think about walking, running, cycling, swimming, as doable without the registration or belonging to groups or associations. Not all the 'active people', in fact, structure their activities in official manners. Nonetheless, usual and typical indexes and indicators focus on the structured supply of sport clubs and facilities for classifying cities and evaluating their performance as healthy and sport-oriented ones. As said, the approach here is that of inserting the

sport-based and activity-based characters of the city into a framework of the 'healthy city' and therefore considering these characters for planning the city of the future.

The composite index developed was applied to the intermediate, province level and considered different inputs coming from analysis on urban quality.

The use of such a combined set of indexes allowed on one side to consider a kind of official 'Sportness' of the different locations considered - in structured terms - while on the other side to evaluate the endowment of the cities considered both in terms of their 'natural' component, and as a result of the policies adopted on urban planning.

We can particularly notice as, of the four Sardinian provinces plus the metropolitan city of Cagliari, that the major urban areas present the highest values of structured endowment, as it can be explained by considering their 'higher order role' played in the regional context by the two major cities - and de facto metropolitan areas. Southern areas, Cagliari and South Sardinia, present the most important values in terms of the unstructured endowment. with a value of 33.28 for the year 2020, while the province of Sassari holds the lower value, as 8.62 for 2020. Analysing the values for the period 2018–2020 it can be noticed that for all the four administrative aggregations (provinces + metropolitan city) the value is fairly constant for the three years. That possibly comes down from the urban policies carried on in the years, whose effects can be observed in such values. The city of Cagliari in particular witnessed the major results from the actions performed by the local authority for the 2017 European Capital of Sport as certified by the European Union.

7 Conclusions

The research so far carried on offered a multi-faceted view of the different areas considered, showing, as a matter of example, that structured activities are more present in major urban areas. This can be considered the effect of a higher presence of services – associations, clubs, etc. - related to sport and physical activities can be related to the proper urban, higher role played by such places. Unstructured activities appear more concentrated on the Southern part of the regions, particularly in the aggregation of the province of South Sardinia and the metropolitan city of Cagliari. Here, investments in bicycle and walking lanes, green spaces, etc., considered as indicators of an attention towards the unstructured activities, appear more present than in the other provinces considered. An observation on a time series analyzed is that investment in such a sense was boosted particularly before the year 2017, when Cagliari was nominated European Capital of sport. In the coming years, the endowments related to these elements remained constant.

Further evolutions of this research imply considering other elements to enrich the composite indicator of structured and unstructured physical activity, other than modeling such index in order to be considered into, and as an effect of, the urban policies adopted. A more refined spatial scale of analysis will also be considered.

References

1. Bedimo-Rung, A.L., Mowen, A.J., Cohen, D.A.: The significance of parks to physical activity and public health. A conceptual model. Am. J. Prev. Med. **28**(22), 159–168 (2005)

2. Ballor, D.L., Keesey, R.E.: A meta-analysis of the factors affecting exercise induced changes in body mass, fat mass, and fat-free mass in males and females. Int. J. Obesity **15**, 717–726 (1991)
3. Hovell, M.F., Sallis, J.F., Hofstetter, C.R., Spry, V.M., Faucher, P., Caspersen, C.J.: Identifying correlates of walking for exercise: an epidemiologic prerequisite for physical activity promotion. Prev. Med. **18**, 856–866 (1989)
4. Phillips, W.T., Pruitt, L.A., King, A.C.: Lifestyle activity. Current recommendations. Sports Med. **22**, 1–7 (1996)
5. Dunn, A.L., Marcus, B.H., Kampert, J.B., Garcia, M.E., Kohl, H.W., Blair, S.N.: Comparison of lifestyle and structured interventions to increase physical activity and cardiorespiratory fitness: a randomized trial. JAMA **281**, 327–334 (1994)
6. Hakim, A.A., Petrovitch, H., Burchfiel, C.M., et al.: Effects of walking on mortality among nonsmoking retired men. NE J. Med. **338**, 94–99 (1998)
7. Manson, J.E., Hu, F.B., Rich-Edwards, J.W., et al.: A prospective study of walking as compared with vigorous exercise in the prevention of coronary heart disease in women. NE J. Med. **341**, 650–658 (1999)
8. Siegel, P., Brackbill, R., Heath, G.: The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. Am. J. Public Health **85**, 706–710 (1995)
9. Brownson, R.C., et al.: Promoting physical activity in rural communities. Walking trail access, use, and effects. Am. J. Prev. Med. **18**(3), 235–241 (2000)
10. Pate, R.R.P.M., Blair, S.N., Haskell, W.L., Macera, C.A., Bouchard, C., et al.: Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA **273**, 402–407 (1995)
11. Baerta, V., Gorusa, E., Metsa, T., Geertsa, C., Bautmans, I.: Motivators and barriers for physical activity in the oldest old: a systematic review. Ageing Res. Rev. **10**, 464–474 (2011)
12. Hallal, P.C., Andersen, L.B., Bull, F.C., Guthold, R., Haskell, W., Ekelund, U.: Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet **380**, 247–257 (2012)
13. Lee, I.M., Shiroma, E.J., Lobelo, F., Puska, P., Blair, S.N., Katzmarzyk, P.T.: Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet **380**, 219–229 (2012)
14. Linke, S.E., Ussher, M.: Exercise-based treatments for substance use disorders: evidence, theory, and practicality. Am. J. Drug Alcohol Abuse **41**(1), 7–15 (2015)
15. World Health Organization: The European Health Report 2009. Health and health systems. http://www.euro.who.int/__data/assets/pdf_file/0009/82386/E93103.pdf. Accessed 20 May 2021
16. Epicentro: Il portale dell'epidemiologia per la sanità pubblica a cura del Centro Nazionale di Epidemiologia, Sorveglianza e Promozione della Salute. http://www.epicentro.iss.it/problemi/attivita_fisica/fisica.asp. Accessed 20 May 2021
17. Istituto Superiore della Sanità (ISS): Centro nazionale di epidemiologia, sorveglianza e promozione della salute (Cnesps): OKkio alla salute: sintesi dei risultati 2019. In: collaborazione con Centro per la prevenzione e il controllo delle malattie (Ccm) del Ministero della Salute e le Regioni
18. Cavallo, F., et al. (eds.): Studio HBSC-Italia (Health Behaviour in School-aged Children): rapporto sui dati 2010. Istituto Superiore di Sanità, Roma (Rapporti ISTISAN 13/5) (2013)
19. Epicentro. Il portale dell'epidemiologia per la sanità pubblica a cura del Centro Nazionale di Epidemiologia, Sorveglianza e Promozione della Salute. La sorveglianza PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia). http://www.epicentro.iss.it/passi/. Accessed 20 May 2021
20. Sallis, J., et al.: An ecological approach to creating active living communities. Annu. Rev. Public Health **27**, 297–322 (2006). https://doi.org/10.1146/annurev.publhealth.27.021405.102100

21. Rebecchi, A., et al.: Walkable environments and healthy urban moves: urban context features assessment framework experienced in Milan. Sustainability **11**, 2778 (2019)
22. Congiu, T., et al.: Built environment features and pedestrian accidents: an Italian retrospective study. Sustainability **11**, 1064 (2019)
23. D'Alessandro, D., et al.: Strategies for disease prevention and health promotion in urban areas. In: The Erice 50 Charter. Ann. Ig. **29**, 481–493 (2017). https://doi.org/10.7416/ai.2017.2179. ISSN: 1120-9135
24. Capolongo, S., et al.: Healthy design and urban planning strategies, actions, and policy to achieve salutogenic cities. Int. J. Environ. Res. Public Health **15**, 2698 (2018)
25. Rydin, Y., et al.: Shaping cities for health: complexity and the planning of urban environments in the 21st century. Lancet **379**, 2079–2108 (2012)
26. Addy, C.L., Wilson, D.K., Kirtland, K.A., Ainsworth, B.E., Sharpe, P., Kimsey, D.: Associations of perceived social and physical environmental supports with physical activity and walking behavior. Am. J. Public Health **94**(3), 440–443 (2004)
27. Bauman, A., Smith, B., Stoker, L., Bellew, B., Booth, M.: Geographical influence upon physical activity participation: evidence of a "coastal effect." ANZJPH **23**(3), 322–324 (1999)
28. Ladu, M., Balletto, G., Borruso, G.: Sport and the city, between urban regeneration and sustainable development. TeMA-J. Land Use Mobility Environ. **12**(2), 157–164 (2019)
29. Capotorti, G., et al.: More nature in the city. Plant Biosyst.-Int. J. Dealing Aspects Plant Biol. **154**(6), 1003–1006 (2020)
30. Ladu, M., Balletto, G., Borruso, G.: Sport and smart communities. Assessing the sporting attractiveness and community perceptions of Cagliari (Sardinia, Italy). In: Misra, S., et al. (eds.) ICCSA 2019. LNCS, vol. 11624, pp. 200–215. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-24311-1_14
31. Balletto, G., Milesi, A., Ladu, M., Borruso, G.: A dashboard for supporting slow tourism in green infrastructures. A methodological proposal in Sardinia (Italy). Sustainability **12**(9), 3579 (2020)
32. Macintyre, H.L., Heaviside, C., Cai, X., Phalkey, R.: Comparing temperature-related mortality impacts of cool roofs in winter and summer in a highly urbanized European region for present and future climate. Environ. Int. **154**, 106606 (2021)
33. Lehnert, M., Savić, S., Milošević, D., Dunjić, J., Geletič, J.: Mapping local climate zones and their applications in European urban environments: a systematic literature review and future development trends. ISPRS Int. J. Geo-Information **10**(4), 260 (2021)
34. Dettori, M., et al.: Air pollutants and risk of death due to COVID-19 in Italy. Environ. Res. **192**, 110459 (2021)
35. Ulpiani, G.: On the linkage between urban heat island and urban pollution island: three-decade literature review towards a conceptual framework. Sci. Total Environ. **751**, 141727 (2020)
36. Maragno, D., Pozzer, G., Musco, F.: Multi-risk climate mapping for the adaptation of the Venice metropolitan area. Sustainability **13**(3), 1334 (2021)
37. Balletto, G., Ladu, M., Milesi, A., Borruso, G.: A methodological approach on disused public properties in the 15-minute city perspective. Sustainability **13**, 593 (2021). https://doi.org/10.3390/su13020593
38. Balletto, G., Milesi, A., Fenu, N., Borruso, G., Mundula, L.: Military training areas as semi-commons: The territorial valorization of Quirra (Sardinia) from easements to ecosystem services. Sustainability **12**(2), 622 (2020)
39. Balletto, G., Borruso, G., Tajani, F., Torre, C.: Gentrification and sport. Football stadiums and changes in the urban rent. In: Gervasi, O., et al. (eds.) ICCSA 2018. LNCS, vol. 10964, pp. 58–74. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-95174-4_5
40. Balletto, G., Borruso, G., Mei, G.: Location theory and circular economy. Demolition, constructions and spatial organization of firms – an applied model to Sardinia Region. The case

study of the New Cagliari Stadium. In: Misra, S., et al. (eds.) ICCSA 2019. LNCS, vol. 11621, pp. 535–550. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-24302-9_38
41. Carmona, M.: Public Places, Urban Spaces: The Dimensions of Urban Design. Routledge, Milton Park (2021)
42. Kellison, T.B., McCullough, B.P.: A pragmatic perspective on the future of sustainability in sport. In: Routledge Handbook of Sport and the Environment, pp. 445–455. Routledge (2017)
43. Camerin, F., Gastaldi, F.: Il ruolo dei fondi di investimento immobiliare nella riconversione del patrimonio immobiliare pubblico in Italia. Urban@ it Background Papers Rapporto sulle città 2018 IL GOVERNO DEBOLE DELLE ECONOMIE URBANE 2/2018, pp. 1–13 (2018)
44. Pedersen, P.M., Ruihley, B.J., Li, B. (eds.): Sport and the Pandemic: Perspectives on Covid-19's Impact on the Sport Industry. Routledge, Milton Park (2020)
45. Di Caro, P., Pagliara, F.: Sportcity. Viaggio nello sport che cambia le città. Malcor D' (2020)
46. ISTAT: Rapporto Bes 2019. Il Benessere Equo e sostenibile in Italia (2019)
47. ISTAT: Rapporto Bes 2020. Il Benessere Equo e sostenibile in Italia (2020)
48. Ronchetti, P.: Regole e numeri dello sport. Zanichelli (2019)
49. Scally, G., Black, D., Pilkington, P., Williams, B., Ige-Elegbede, J., Prestwood, E.: The application of 'elite interviewing' methodology in transdisciplinary research: a record of process and lessons learned during a 3-year pilot in urban planetary health research. J. Urban Health **98**, 404–414 (2021). https://doi.org/10.1007/s11524-021-00542-1
50. ISTAT. https://www.istat.it/it/benessere-e-sostenibilit%C3%A0/la-misurazione-del-benessere-(bes)/gli-indicatori-del-bes. Accessed 27 May 2021
51. ISTAT. https://www.istat.it/it/archivio/254761. Accessed 27 May 2021
52. ASviS. https://asvis.it/public/asvis2/files/Pubblicazioni/RAPPORTO_ASviS_TERRITORI_2020.pdf. Accessed 27 May 2021
53. Kiuppis, F.: Inclusion in sport: Disability and participation. Taylor & Francis Online (2018)
54. Balletto, G., Borruso, G.: Sport and city. The case of Cagliari's new stadium (Sardinia – Italy). In: Proceedings of the 22nd IPSAPA/ISPALEM International Scientific Conference Aversa/Caserta (Italy), 2nd–3rd July 2018, pp. 231–240 (2018)
55. Moeinaddini, M., Asadi-Shekari, Z., Aghaabbasi, M., Saadi, I., Shah, M.Z., Cools, M.: Applying non-parametric models to explore urban life satisfaction in European cities. Cities **105**, 102851 (2020)
56. Il Sole 24 Ore. https://lab24.ilsole24ore.com/indiceSportivita/index.php. Accessed 27 May 2021
57. Il Sole 24 Ore. https://lab24.ilsole24ore.com/ecosistema-urbano/index.php. Accessed 27 May 2021
58. Legambiente. https://www.legambiente.it/wp-content/uploads/2020/11/Ecosistema-Urbano-2020.pdf. Accessed 27 May 2021
59. Romano, B., Zullo, F., Marucci, A., Fiorini, L.: Vintage urban planning in Italy: land management with the tools of the mid-twentieth century. Sustainability **10**, 4125 (2018). https://doi.org/10.3390/su10114125
60. Fabris, L.M.F., Balzarotti, R.M., Semprebon, G., Camerin, F.: New healthy settlements responding to pandemic outbreaks. Approaches from and for the global city (2020)